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Reviewed work(s):
Source: *The American Political Science Review*, Vol. 78, No. 4 (Dec., 1984), pp. 952-958
Published by: American Political Science Association
Stable URL: http://www.jstor.org/stable/1955800
Accessed: 28/09/2012 14:54

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The Problem of Strategic Behavior under Approval Voting

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Approval voting is being promoted as "the election reform of the 20th century" (Brams, 1980, p. 105), and indeed if voters' preferences are dichotomous, approval voting has some remarkable qualities: it is uniquely strategy-proof, a candidate wins if and only if he is a Condorcet winner, and voters have simple strategies that are at once sincere and sophisticated. However, all of these results depend on the existence of dichotomous preferences, a contrived and empirically unlikely assumption. Here I show that these virtues of approval voting are replaced by some rather undesirable features under more plausible assumptions. More fundamentally, rather than promoting "honest" behavior, as is sometimes implied, the existence of multiple sincere strategies almost begs voters to behave strategically. I also examine sophisticated approval voting and show that in the general case it need not pick a Condorcet alternative. Ironically, there is a condition under which Condorcet winners may always be picked, but for this to occur, voters sometimes have to vote for candidates of whom they disapprove.

Approval voting—a voting system for multicandidate elections in which a voter may vote for as many candidates as he or she wishes—is being promoted as "the election reform of the 20th century" (Brams, 1980, p. 105). In fact, if voters' preferences are dichotomous, approval voting has some remarkable qualities: it is uniquely strategy-proof, a candidate wins if and only if he is a Condorcet winner, and voters have simple strategies that are at once sincere and sophisticated (Brams & Fishburn, 1978). However, all of these results depend on the existence of dichotomous preferences, a contrived and empirically unlikely assumption.

Here I show that these virtues of approval voting are replaced by some rather undesirable features under more plausible assumptions. Whereas Brams speaks of approval voting as discouraging strategic or manipulative behavior (Fishburn & Brams, 1981, p. 90), I conclude exactly the opposite: "sincere" approval voting leaves so much ambiguity that voters are almost begged to think and behave strategically. In light of this argument in the section on sincere approval voting, I go on to look at "sophisticated" approval voting in the third section. If voters are sophisticated, approval voting under certain circumstances retains at least one desirable property. Ironically, however, if voters divide candidates into approved and disapproved sets, approval voting retains this property only if individuals are willing to vote for disapproved candidates.[1]

Definitions and Assumptions

DEFINITION 1. APPROVAL VOTING (AV). *A system of voting for multicandidate ($\geqslant 3$) elections that allows a voter to vote for as many candidates as he or she wishes.* A voter can cast no more than one vote per candidate (i.e., no cumulative voting), and the candidate with the greatest number of votes wins.

DEFINITION 2. SINCERE APPROVAL VOTING. *A voter votes sincerely "if and only if, whenever he votes for some candidate, he votes for all candidates preferred to that candidate"* (Brams, 1982, p. 10). Note that this definition includes nothing about approval as such; it does not re-

Received: May 19, 1983
Revision received: October 18, 1983
Accepted for publication: February 17, 1984

I would like to thank Steven Brams, Arthur Frank, Keith Krehbiel, and the anonymous referees for their comments on a draft of this article, an earlier version of which was presented at the Annual Meeting of the Public Choice Society, Savannah, Georgia, March 24-26, 1983.

[1]As an anonymous referee pointed out, one useful perspective is to ignore any implications of the word *approval* and simply to think of the multiple votes as one possible way of aggregating preferences. Then my results can be viewed in part as an application of the Gibbard (1973) and Satterthwaite (1975) theorem showing that all such voting schemes are manipulable. It is useful, however, to point out the extent of manipulability and the kinds of results (e.g., Condorcet losers winning) that can occur as a result of the manipulation. If one does lend credence to the notion of approval, then it is worth pointing out some of the consequences of that view.

quire voting only for "approved" alternatives. This definition will be discussed more fully below.

DEFINITION 3. CONDORCET CANDIDATE. *A Condorcet candidate is a candidate who is preferred by a majority in pairwise voting against all other candidates.* In pairwise voting it is assumed that a voter would always vote for the candidate ranked higher in his preference ordering.

DEFINITION 4. CONDORCET LOSER. *A Condorcet loser is a candidate who is defeated by a majority in pairwise voting against all other candidates.*

Assumption 1. Nondichotomous Preferences. At least some voters have nondichotomous preferences. Dichotomous preferences are characterized as those in which voters divide candidates into two groups, those they approve of and those they disapprove of; in addition, voters do not distinguish among the candidates in each group, that is, all the candidates of whom they approve of are equally approved and all those they disapprove of are equally disapproved. Nondichotomous preferences therefore include any other sort of preferences, such as the following, where parentheses indicate indifference among the candidates: *abc, a(bc)d, (ab)cd, (ab)(cd)e, ab(cde).* I will deal with only three alternatives and for the most part assume that preferences are linear, that is, that there is no indifference at all. However, all results hold in the presence of some indifference (as in several of the nondichotomous preferences illustrated just above), and if some but not all voters have dichotomous preferences.

Assumption 2. Approval and Disapproval Sets. Sometimes I will assume that voters can divide alternatives into approved and disapproved classes.

Note, however, that because I am dealing with nondichotomous preferences, I do not necessarily imply indifference among alternatives in a given set. For example, a voter may approve of two alternatives but still prefer one of these more than the other.

Assumption 3. Bloc Voting. I will assume that all individuals in a bloc vote identically, where a bloc is defined as voters with the same preference ordering.

This assumption is unnecessary for analyzing sincere voting. Although I use it for convenience, none of the results in the first part of the article depends on it. However, to examine sophisticated strategies, bloc voting is virtually required if strategies and outcomes are to be determinate; this is discussed more fully in the third section.

For the analysis of sophisticated voting, three other assumptions are also required.

Assumption 4. Knowledge. Voters have complete knowledge of others' preference orderings.

Assumption 5. Tied Outcomes. Two of the examples require the assumption that tied election outcomes are broken randomly.

Assumption 6. Noncooperative Game. Blocs act independently of one another.

Sincere Approval Voting

Result 1. In the absence of dichotomous preferences, there is more than one sincere strategy under AV. As a consequence, AV almost begs the voter to think and behave strategically.

Sincere voting typically implies nonstrategic or what might even be called *honest* behavior: that an individual votes "directly in accordance with his preferences" (Brams, 1975, p. 56).[2] But if one has linear preferences, this definition is problematic under AV. Suppose, for example, one has the preference ordering *abcdef.* Surely it would not be sincere to vote for *b* and not to vote for *a,* because one prefers *a* to *b*; likewise, it is not sincere to vote for *d* and not for *a, b,* and *c,* because they are all preferred to *d.* But how does one express his true preferences? Should he vote only for *a*? For *a* and *b*? For *a, b* and *c*? Or what? All of these votes satisfy the definition of sincere AV, but they are obviously not equivalent. Nor are they likely to lead to equivalent outcomes.

If a voter has a set of approved candidates, sincere AV might be more constrained. For example, if one approves of both *a* and *b* and disapproves of *c-f* (but rates *a* above *b*), then perhaps voting for both *a* and *b* and no others should be considered sincere. But this is not perfectly obvious; after all, one does prefer *a* to *b.*[3] Still, if individuals typically divided candidates into two groups—approved and disapproved—the definition of sincere voting could be altered to take this into account. But I view this assumption as highly implausible. Moreover, we would still have to look at the potential for strategic behavior, and my analysis below of sophisticated AV will suggest that the presence of approved and disapproved sets creates severe problems in the event that voters are sophisticated.

The fact that sincere AV (with nondichotomous preferences) fails to yield unique strategies is of major significance; it means that, under AV, to

[2] "Sincere strategies are essentially strategies that directly reflect the true preferences of a voter, i.e., that do not report preferences 'falsely' " (Brams & Fishburn, 1978, p. 837).

[3] Notice that the definition of sincere AV does not require voting for both *a* and *b*; it requires only that *if* one votes for *b,* then one also votes for *a.* (This distinction is not always so nicely maintained. See, for example, Brams, 1982, p. 7).

say voters use sincere strategies is not equivalent to saying that they make no strategic calculations.[4] In fact, the existence of multiple, equally sincere strategies suggests to me that AV would encourage strategic (albeit sincere) voting. Thus, far from promoting honest or true expressions of preferences, AV is likely to promote strategic thinking and behavior.[5] Indeed, in the closest existing analogue to AV—multiple votes and multiple winners, as in some judicial and school board elections—voters easily learn the strategic behavior called bullet voting (voting only for one's most preferred candidate).

One can respond to this point by trying to make multiple sincere strategies a virtue of AV. Under AV, voters are never urged to vote insincerely, whereas under plurality voting they must consider an insincere vote (e.g., second place voting). But this merely proves the point. If voters dislike insincere behavior, they will not vote strategically under plurality voting. In contrast, under AV sincere voters are still left with multiple strategies to consider.

Although it thus seems likely that AV would greatly encourage strategic behavior, it is worthwhile to derive a few results for sincere AV anyway. We will quickly see that one of the nice properties associated with AV—the selection of Condorcet candidates—is not retained under the more general circumstances of nondichotomous preferences. In fact, quite the contrary is true.

Result 2. In the absence of dichotomous preferences, sincere AV need not select a Condorcet candidate.

Example 1 demonstrates this point. Let there be six voters, with the preferences indicated in Example 1. As noted, sincere voting requires only that if an individual votes for a given candidate, he votes for all candidates ranked higher in his preference ordering. Therefore, individuals might vote sincerely as indicated in Example 1. If so, *b* wins 5-4, even though *a* is a Condorcet candidate. In fact, this example demonstrates as well another result.

Result 3. In the absence of dichotomous preferences, sincere AV need not select a candidate who has a majority of first place preferences.

Result 4. In the absence of dichotomous preferences, sincere AV may select a Condorcet loser.[6]

Example 1

Number of Voters	Preference Ordering	Vote	Approval Vote Results
3	*abc*	*a,b*	*a* = 4
1	*acb*	*a*	*b* = 5
2	*bca*	*b*	*c* = 0

Example 2 demonstrates this point. Candidate *c* wins under AV even though he is less preferred than both other candidates in pairwise comparisons (*a* > *c*, 20-16; *b* > *c*, 24-12).

Example 2

Number of Voters	Preference Ordering	Vote	Approval Vote Results
11	*abc*	*a*	*a* = 14
3	*acb*	*a,c*	*b* = 13
6	*bac*	*b*	*c* = 19
7	*bca*	*b,c*	
9	*cba*	*c*	

Result 5. In the absence of dichotomous preferences, sincere AV may select a candidate whom a majority of voters prefers least.

Note that in Example 3 the first two blocs, 17 of the 33 voters, rank *c* last; yet *c* wins.

Result 6. A Condorcet candidate may receive the fewest approval votes, so even with a runoff election among the top two candidates, the winner under sincere AV need not be a Condorcet alternative.

This result is demonstrated by the example used to illustrate Result 4 (Example 2). Candidate *b* is ranked above both others by wide margins in pair-

[4]Tullock (1979) made this same point a few years ago.

[5]Brams and Fishburn imply strongly that AV is more honest because it is more sincere: "A voting system that encourages sincere voting, it seems, would probably produce higher voter turnout. By allowing voters to tune their preferences more finely, *and by forcing them less often to make insincere choices for strategic reasons,* approval voting may well stimulate more voters to express themselves at the polls and enhance their attitudes towards the system" (1978, p. 838, emphasis added).

[6]Nurmi (1983, p. 188) discovered this independently.

Example 3

Number of Voters	Preference Ordering	Vote	Approval Vote Results
11	*abc*	*a*	*a* = 15
6	*bac*	*b*	*b* = 9
3	*bca*	*b,c*	*c* = 16
4	*cab*	*c,a*	
9	*cba*	*c*	

wise comparisons ($b > a$, 22-14; $b > c$, 24-12). Yet under AV b comes in third and would not even get into the runoff election.

Sophisticated Approval Voting

Having argued that when preferences are nondichotomous, sincere AV creates numerous opportunities for strategic behavior and may lead to undesirable outcomes, it is important to look at strategic AV. When the choice is nonbinary, however, that is, more than two alternatives are being voted on at once—it is not immediately obvious how one ought to behave from a strategic point of view. For one thing, one almost surely has to assume bloc voting along with other assumptions about how all other voters will think and behave. Otherwise the situation is hopelessly indeterminate.[7] Yet having made these somewhat unrealistic assumptions, analysis of strategic voting leads to further disturbing conclusions about AV.

The perspective on strategic voting that I adopt here is that of Farquharson (1969). Farquharson's definition is logically compelling; it calls for a voter to consider all possible combinations of votes by others and then to see in each of these cases what differences, if any, his own vote makes. The voter then eliminates strategies that are dominated, that is, for which there is some other strategy that is always at least as good and sometimes better. Other voters are assumed to do the same. This process of reducing the available strategies (which may go on for several rounds) thus tells the voter what strategy or strategies are best in all possible circumstances. These are the sophisticated strategies. (The examples below will breathe life into this description; for complete details, see Farquharson, 1969, pp. 38-49).

Now let us see what happens under AV if voters think strategically in this way.

Result 7. In the absence of dichotomous preferences, but with voters defining sets of approved and disapproved candidates and considering voting only for the former, sophisticated AV need not select a Condorcet candidate.

Consider Example 4. In this simple case it is easy to apply Farquharson's definition. All of the relevant information is contained in a brief table in the example. Note first that by assumption the blocs with preference orderings *abc* and *cba* will always vote for *a* and *c*. The bloc with preference ordering *bac,* however, considers voting for either its first choice, *b,* or for both its first and second choice, *b* and *a* (symbolized as *ba*).[8] Likewise, the bloc with preference ordering *bca,* considers voting for *b* or for *bc*. Since two blocs each consider two strategies, there are $2 \times 2 = 4$ possible voting patterns with the outcomes indicated. Each of the two blocs with a choice then considers what outcome will be achieved by its various possible votes. For example, bloc *bac* is indifferent about its behavior because its vote makes no difference; if it votes *b* while the other blocs vote *a, b, c,* the outcome is *a* (voting pattern 1); if it shifts its vote to *ba* while no other bloc changes (voting pattern 3), the outcome is still *a*. The same absence of effect is apparent if one compares voting patterns 2 and 4. In contrast, bloc *bca* is always better off voting for *bc*. (The voting patterns to compare for this bloc are 1 vs. 2 and 3 vs. 4.) Thus there is only one "reduction" as shown in Example 4, and with the votes cast as shown (no matter which way bloc *bac* votes), alternative *c* wins. The Condorcet alternative, *b* ($b > a$, 19-11; $b > c$, 21-9), obtains the fewest votes.

Because Result 7 depends on some individuals restricting the strategies they consider, it is worthwhile to examine sophisticated AV without that restriction. This approach alters the situation somewhat and leads ultimately to an ironic conclusion.

[7]See Niemi and Frank (1982, p. 153). The example in that study uses the plurality procedure, but it can be very simply modified to fit AV.

[8]Voting for one's last choice is never advantageous (Brams & Fishburn, 1978, p. 836, Corollary 1).

Example 4

Number of Voters	Preference Ordering	Approved Candidates	Voting Patterns 1	2	3	4	First and Only Reduction[a]	Sophisticated Voting Results[a]
11	*abc*	*a*	*a*	*a*	*a*	*a*	*a*	*a* = 11 or 14
3	*bac*	*b,a*	*b*	*b*	*ba*	*ba*	*b* or *ba*	*b* = 10
7	*bca*	*b,c*	*b*	*bc*	*b*	*bc*	*bc*	*c* = 16
9	*cba*	*c*	*c*	*c*	*c*	*c*	*c*	
	Outcomes		*a*	*c*	*a*	*c*		

[a]As defined by Farquharson (1969).

Example 5

Number of Voters	Preference Ordering	Voting Patterns 1	2	3	4	5	6	7	8
50	*acb*	*a*	*a*	*a*	*a*	*ac*	*ac*	*ac*	*ac*
31	*bca*	*b*	*b*	*bc*	*bc*	*b*	*b*	*bc*	*bc*
20	*cba*	*c*	*cb*	*c*	*cb*	*c*	*cb*	*c*	*cb*
	Outcomes	*a*	*b*	*c*	*b/c* tie	*c*	*c*	*c*	*c*

Result 8. In the absence of dichotomous preferences, sophisticated AV strategies sometimes include voting for one alternative and sometimes for more than one alternative.

This simple result—demonstrated by numerous examples, including Table 2—means that even with only three alternatives there is no one voting strategy that is optimal. Each situation has to be examined separately. Considering a number of such cases leads to the following results.

Result 9. In the absence of dichotomous preferences, sophisticated AV may be indeterminate with respect to both individual strategies and outcomes. This is so even if there is a Condorcet alternative.

Witness Example 5. Neither first nor first-and-second place voting is dominated for any bloc as shown below:

First bloc: Comparing patterns 1 and 5, voting for *a* is preferred; Comparing patterns 2 and 6, voting for *a* and *c* is preferred.

Second bloc: Comparing patterns 2 and 4, voting for *b* is preferred; Comparing patterns 1 and 3, voting for *b* and *c* is preferred;

Third bloc: Comparing patterns 3 and 4, voting for *c* is preferred; Comparing patterns 1 and 2, voting for *c* and *b* is preferred.

There is a Condorcet candidate ($c > a$, 51-50; $c > b$, 70-31). Nevertheless, no strategies at all can be eliminated; any of the three alternatives may be the outcome depending on just how each bloc votes.

Result 10. In the absence of dichotomous preferences, sophisticated AV may yield a determinate outcome in the presence of cyclical social preferences.

This result is easily shown in the example in Table 1.

Results 9 and 10 are noteworthy because Brams and Fishburn (1978, p. 839) observed for dichotomous preferences that (if voters use only admissible strategies) a candidate will win if and only if he is a Condorcet candidate. Neither implication is true if preferences are nondichotomous and voting is sophisticated. When sophisticated voting is indeterminate, all strategies that have not been eliminated are sophisticated (i.e., ultimately admissible). Result 9 therefore shows that a candi-

Table 1. A Situation with Linear Preferences in Which There Are Cyclical Preferences and a Determinate Outcome with Sophisticated Approval Voting

Number of Voters	Preference Ordering	Voting Patterns 1	2	3	4	5	6	7	8
4	*abc*	*a*	*a*	*a*	*a*	*ab*	*ab*	*ab*	*ab*
2	*bca*	*b*	*b*	*bc*	*bc*	*b*	*b*	*bc*	*bc*
3	*cab*	*c*	*ca*	*c*	*ca*	*c*	*ca*	*c*	*ca*
	Outcomes	*a*	*a*	*c*	*a*	*b*	*a*	*b*	*a*

Social Preference	First Reduction	Second Reduction	Third (Final) Reduction	Sophisticated Voting Results
$a > b$ 7-2	*a* or *ab*	*ab*	*ab*	$a = 7$
$b > c$ 6-3	*bc*	*bc*	*bc*	$b = 6$
$c > a$ 5-4	*c* or *ca*	*c* or *ca*	*ca*	$c = 5$
therefore *abca*				

date will not necessarily win under sophisticatd AV *if* he is a Condorcet candidate. Result 9 (for the indeterminate case) and Result 10 (for the determinate case) show that the winner of sophisticated AV is not necessarily a Condorcet winner. Thus we have:

Result 11. In the absence of dichotomous preferences, and with voters considering all possible sincere strategies, sophisticated AV need not select a Condorcet candidate.

Finally, consider what happens if voters define sets of approved and disapproved candidates but determine optimal strategies without reference to them. Then we have:

Result 12. In the absence of dichotomous preferences, sophisticated AV strategies may involve voting for less than all of the approved candidates or for one or more of the disapproved candidates.

A single example, displayed in Table 2, shows both of these cases. The five voters with preference ordering *acb* approve of both *a* and *c,* but their sophisticated strategy involves voting only for *a.* Those with preference ordering *bca* approve only *b*; yet their sophisticated strategy requires voting for both *b* and *c*!

This creates an ironic situation: if voters define some candidates as disapproved and consequently do not even consider voting for them, Result 7 tells us that sophisticated AV may select an outcome that is not the Condorcet candidate. Voters might in some circumstances retain this desirable feature, as the last example (Table 2) shows.[9] As noted, however, this can require them to vote for disapproved candidates. Thus, at the very least, these presumably desirable properties of AV—voting for all approved candidates and no others and the selection of Condorcet candidates—become unhinged.

Conclusion

A close reading of Brams's work—he is the most ardent supporter of AV—shows that he is well aware of both the advantages and disadvantages of AV. In a nontechnical introduction prepared as a teaching manual, he states that AV "is no panacea for the voter who wants to discriminate among more than two classes of candidates" (1978, p. 62). In fact, in one sense Brams goes overboard by stating that "if and only if a voter has dichotomous preferences will he have a dominant strategy" (p. 62).[10] He also notes that AV "might encourage additional candidates to run . . . and thereby weaken the two party system" (p. 63), and in a recent article (1982), he talks about the problem of strategic information in elections and presents examples that illustrate some of the same points made here (e.g., individuals vote for disapproved candidates or, in what amounts to the same thing, alter their approval sets for strategic reasons).

Despite all of these caveats, however, and despite other supporting arguments (e.g., "it would give minority candidates their proper due,"

[9]Gretlein and Niemi (1984) have shown that this example illustrates a general result. With three alternatives, if there are no restrictions on the strategies considered, if there is a Condorcet candidate, and if sophisticated AV is determinate, the winner will always be the Condorcet candidate.

[10]This result, which is also stated on p. 34 (Brams, 1978) as Theorem 2, is correct in the context in which it is presented, but if one knows others' preferences, there may be a dominant strategy even with nondichotomous preferences. This is shown in most of the examples in this article.

Table 2. A Situation with Linear Preferences and Approved and Disapproved Candidates Showing that Sophisticated Strategies Require Voting for Other than All Approved Candidates

Number of Voters	Preference Ordering	Approved Candidates	Voting Patterns 1	2	3	4	5	6	7	8
5	*acb*	*a,c*	*a*	*a*	*a*	*a*	*ac*	*ac*	*ac*	*ac*
4	*bca*	*b*	*b*	*b*	*bc*	*bc*	*b*	*b*	*bc*	*bc*
3	*cab*	*c*	*c*	*ca*	*c*	*ca*	*c*	*ca*	*c*	*ca*
		Outcomes	*a*	*a*	*c*	*a*	*c*	*a/c* tie	*c*	*c*

First and Only Reduction	Sophisticated Voting Results
a	*a* = 5
bc	*b* = 4
c	*c* = 7

Brams, 1980), AV has begun to receive some strong endorsements, in large part I suspect—at least among academics—because of its very favorable properties when one assumes dichotomous preferences. My purpose in this article, therefore, was to confront very directly the question of what properties characterize AV when preferences are not dichotomous.[11]

The results strip away some of the gloss previously associated with AV. Strategic calculations are endemic to AV even though all of the votes considered are called sincere. Given the literature's emphasis on approval and disapproval sets —even the name, *approval*—and the fact that voting for all approved candidates and no others is optimal for dichotomous preferences, one gets the false impression that AV will eliminate strategic thinking and voting. The results here show that this is far from true, however.

Recent work by Brams (1982) actually adds to this characterization. Brams defines a "polling assumption," by which he suggests how voters might respond to information about candidate preferences. The work begins with an initial poll in which respondents tell whom they would vote for under AV. Brams then shows how following the polling assumption would cause voters to expand or contract the set of candidates for whom they would vote. But this is simply another kind of strategic voting (i.e., in addition to Farquharson's sophisticated voting). Moreover if polling were done repeatedly, this is an obvious invitation to give out deceptive information in subsequent polls—yet another kind of strategic behavior. Even if one assumes the truthful division into approved and disapproved candidates in the initial poll, one surely cannot make that assumption in later polls.[12]

Thus, perhaps the only way that supporters of AV can argue for truthful behavior is to say that the computations are so complex that voters would be unable to make any strategic calculations. But ignorance of how to analyze the situation does not make the problem disappear. One would still be faced in the voting booth with multiple strategies and no obvious way to translate one's feelings into a vote. Uncertainty about one's own behavior as well as about how other people turned their preferences into votes could, I believe, only lead to cynicism about the entire process.

If, instead, one feels that voters could understand the strategic calculations, the results in the third section show that AV has all of the same characteristics (of indecisiveness and of non-Condorcet candidates winning) as other forms of voting. Thus, however one looks at it, although AV may indeed promote sincere voting and under unusual conditions (dichotomous preferences) have other nice properties, in the general case it is neither honest, strategy proof, nor wise.

[11]There is "comparative" work on voting systems (e.g., Merrill, 1983) that does not assume dichotomous preferences and that appears quite favorable to AV. However, such simulations cannot answer the question posed by this article. Most especially, they cannot tell us how voters would respond to the multiple sincere strategies available under approval voting.

[12]In addition, as Brams shows, continual polling and voter adjustments in response to this polling may lead to an indeterminate outcome or to the defeat of a Condorcet candidate.

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